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IODINE NUTRITIONAL STATUS OF THE SCHOOL-AGE CHILDREN IN SOUTH TRIPURA, NORTH EAST INDIA

AMAR K. CHANDRA*, INDRAJIT RAY AND PRASENJIT RAY

Department of Life Sciences,
Tripura University,
Agartala – 799 004

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Abstract : To evaluate the iodine nutritional status, the thyroids of 3,577 school-age children of both sexes are examined clinically by palpation for goiter prevalence, 345 urine samples are analysed by dry ashing to determine the urinary iodine excretion pattern and 121 edible salt samples collected from house hold are analysed by iodometric titration to monitor the iodination achieved through salt from 6 representative areas of South Tripura in goiter endemic North East India. Endemic goiter is found prevalent in all the study areas though its occurrence varies from 13.95% to 30.96%, indicating that clinically mild to severe degree of iodine deficiency prevails in the region. But the pattern of median urinary iodine level of the studied population shows that there is no biochemical iodine deficiency. In 66.94% salt samples had iodine content less than the recommended level of 15 ppm. As per the classification recommended by WHO/UNICEF/ICCIDD, South Tripura falls into goiter endemic by clinical criteria and no endemicity by biochemical criteria. However, iodine deficiency disorders (IDD) continue to be prevalent in the region.

Key words : endemic goiter, iodine nutrition, goitrogens, IDD, public health, school children

INTRODUCTION

Goiter is the most prevalent clinical manifestation of iodine deficiency and thus its prevalence rate is used as an indicator to evaluate the iodine nutritional status in a well defined region (1). The entire north eastern region of India including Tripura is in the classical goiter endemic belt of India (2). The overall 17% goiter prevalence was reported in Tripura by Central Goiter Team in 1970 (3). Recognising the economic loss caused by iodine deficiency disorders (IDD), the entry of non-iodised salt in North East India was banned in 1988–1989 and thus the people of Tripura are using the edible salt fortified with iodine since then. However goiter surveys conducted in the different regions of the State showed that in the capital city Agartala the prevalence rate was 38% (4), in West Tripura district was 23.32% (5) and in South Tripura district was 24.22% (6), indicating that IDD still persists in the State. Goiter prevalence of the school aged children indicates the correct status of iodine deficiency in general

*Corresponding Author

population (7), while urinary iodine excretion level indicates the average iodine consumption (8). The knowledge on the iodine nutritional status of the people of the goiter endemic Tripura is grossly insufficient. Therefore the present study has been undertaken to ascertain the current iodine nutritional status in South Tripura as evidenced by goiter prevalence and urinary iodine excretion level of the school-age children. Simultaneously the iodine content of the edible salt is determined to monitor the iodine content at the consumption level.

METHODS

South Tripura district is one of the three districts in the State of Tripura, located in the north eastern region of India. The district comprises of the entire southern region of the State. Geographically the district is surrounded by Bangladesh in three sides. Its total area is about 3,909 square km and population is 766,014 which is almost 1/4 of the total population of the State (1991 Census). There are six rural blocks and four urban localities. For the purpose of the present study five areas were selected one from each of the rural blocks (except the Dumburnagar block) and one from the urban localities by the Purposive Sampling Method (9) to get proportionate representation. In each study area one school was selected at random and the students of the age group 6–15 yrs from both sexes were considered as target group. All the students of the school who were present on the day of survey were clinically examined to investigate the enlargement of thyroid gland or goiter by palpation method (10) i.e. when the thyroid lobe found larger than the examinee's thumb is considered as goitrous.

In each study area at least 40 urine samples were collected at random covering all the classes from target group in the marked wide mouth screw capped plastic bottles for the assay of urinary iodine. The collected urine samples were brought to the laboratory adding toluine as preservative and kept at 4°C until analysis. On the day of analysis the samples were brought to room temperature. The iodine content of urine was estimated by dry ashing method in presence of sodium carbonate and then iodide present in the ash was measured by cerric-arsenite system (11).

The students of the schools were instructed to carry with them the edible salt from their house-holds. At random 15 to 20 samples were collected in the marked container and the iodine level of the salt samples was measured by iodometric titration (12).

The entire study was conducted during the period from January 1996 to July 1996.

RESULTS

The epidemiological criteria for assessing the severity of Iodine Deficiency Disorders (IDD) based on goiter prevalence and urinary iodine level (1) was shown in Table I.

In 6 study areas of South Tripura district 3,577 school-age children are clinically examined for goiter prevalence and the total goiter rate is 24.35%. Endemic goiter is prevalent in all the study areas

with highest (30.86%) in Dakshin Chandrapur and the lowest rate (13.95%) have been noticed in Arya Colony. Existing goiter rate indicates that IDD is mild public health problem in Arya Colony; moderate public health problem in Bhuratali, Jolaibari, Kalabaria, and Rajkang but a severe public health problem in Dakshin Chandrapur. The prevalence of goiter in different study areas with severity as public health problem is shown in Table II.

The pattern of urinary iodine excretion of the target population from the different study areas of South Tripura is shown in

TABLE I : Summary of Iodine Deficiency Disorders (IDD) prevalence indicators and criteria for a public health problem.

Indicator	*Target population*	*Severity of Public Health Problem*		
		Mild	*Moderate*	*Severe*
Total goiter rate	SAC*	5.0 – 19.9%	20.0 – 29.9%	>30.0%
Median urinary iodine level µg/dl	SAC*	5.0 – 9.9	2.0 – 4.9	<2

*SAC = School aged children

TABLE II : Goiter prevalence in different study areas of South Tripura showing its severity as public health problem.

Sl. No.	*Study areas (Block)*	*Location*	*Population studied*	*Goiter affected*	*% of goiter affected population*	*Severity as public health problem*
1.	Bhuratali (Satchand)	Rural	737	181	24.56%	Moderate
2.	Jolaibari (Bagafa)	Rural	724	172	23.76%	Moderate
3.	Arya Colony (Belonia NP)	Urban	344	48	13.95%	Mild
4.	Kalabaria (Rajnagar)	Rural	514	112	21.79%	Moderate
5.	Dakshin Chandrapur (Matabari)	Rural	648	200	30.86%	Severe
6.	Rajkang & Rangkang (Amarpur)	Rural	610	158	25.90%	Moderate
	Total		3,577	871	24.35%	

TABLE III : Urinary iodine level of the studied population from different study areas of South Tripura.

Sl. No.	Study areas	Total sample studied	Urinary iodine level (µg/dl)				
			0–1.9	2.0–4.9	5.0–9.9	10–20	>20
1.	Bhuratali	47	3 (06.38%)	0 (00.00%)	10 (21.28%)	15 (31.91%)	19 (40.43%)
2.	Jolaibari	51	4 (07.84%)	2 (03.92%)	5 (09.80%)	26 (50.98%)	14 (27.45%)
3.	Arya Colony	75	7 (09.33%)	1 (01.33%)	11 (14.67%)	24 (32.00%)	32 (42.67%)
4.	Kalabaria	52	2 (03.85%)	2 (03.85%)	11 (21.15%)	21 (40.38%)	16 (30.77%)
5.	Dakshin Chandrapur	40	6 (15.00%)	2 (05.00%)	5 (12.50%)	15 (37.50%)	12 (30.00%)
6.	Rajkang & Rankang	80	2 (02.50%)	8 (10.00%)	15 (18.75%)	24 (30.00%)	31 (35.75%)
	Total	345	24 (06.96%)	15 (04.35%)	57 (16.52%)	125 (36.23%)	124 (35.94%)

Table III. In all 345 urine samples were collected at least 40 samples from each study area. The urinary iodine excretion levels of the studied population are expressed in five categories to show the proper distribution of iodine excretion.

The overall iodine excretion levels shows that 35.94% population had iodine level above 20 µg/dl, 36.23% population had iodine level in the range of 10–20 µg/dl. However, 16.52% population had iodine level in the range of 5–9.9 µg/dl indicating mild iodine deficiency, 4.35% population was in the range of 2–4.9 µg/dl showing moderate iodine deficiency and 6.96% studied population had iodine level in the range of 0–1.9 µg/dl showing severe iodine deficiency.

Iodine nutritional status as evidenced by the median urinary iodine excretion level from the different study areas of South Tripura is shown in Table IV. The results indicate that there is no biochemical iodine deficiency in the study areas.

TABLE IV : Iodine nutritional status evidenced by median urinary iodine level from study areas in South Tripura.

Sl. No.	Study areas	Median urinary iodine level (µg/dl)	Iodine nutritional status
1.	Bhuratali	16.5	No deficiency
2.	Jolaibari	15.0	No deficiency
3.	Arya Colony	16.5	No deficiency
4.	Kalabaria	16.5	No deficiency
5.	Dakshin Chandrapur	11.5	No deficiency
6.	Rajkang & Rangkang	12.5	No deficiency

A total of 121 salt samples were collected from the study areas at least 15 samples from each area. It was found that 81 salt samples (66.94%) had iodine less than the recommended level 15 ppm; iodine content

of 25 salt samples (20.66%) was in the range of 15–30 ppm and the remaining 15 salt samples (12.40%) had iodine more than 30 ppm as shown in Table V.

TABLE V : Iodine content of salt samples from study areas in South Tripura.

Total salt samples studied	*Iodine content*		
	<15 ppm	*<30 ppm*	*>30 ppm*
121	81 (66.94%)	25 (20.66%)	15 (12.40%)

DISCUSSION

The prevalence of endemic goiter in Tripura was studied for the first time in 1970 (3) and iodised salt as prophylactic measure to prevent IDD was started since 1987–88. The present study shows overall 24.35% goiter prevalence of the school-age children in South Tripura against 24.22% goiter prevalence of the population covering all the age groups in 1993–94 (6) in the district. The effectiveness of iodine prophylaxis to prevent goiter and associated iodine deficiency disorders has been established in India. It was found that after 6 years of iodination the goiter prevalence decreased from 38% to 19% and from 38% to 15% after the use of salt fortified with potassium iodide and iodate respectively in the dose of 200 µg of iodine per person per day (13,14). This work shows that Arya Colony is mildly endemic, Bhuratali, Jolaibari, Kalabaria and Rajkang & Rangkang are moderately endemic and Dakshin Chandrapur is severely endemic area by clinical criteria as per classification recommended by WHO/UNICEF/ICCIDD.

The urinary iodine level reflects the iodine consumption of an individual as the body's 90% iodine is excreted through urine and thus the concentration of iodine in the urine is used as biochemical marker of iodine intake (8). It has been recommended that iodine content in urine samples collected at random from 40 subjects in a locality represents the valid estimate about the iodine intake of general population of that locality (15). According to epidemiological criteria (1) the median urinary iodine level available from the six study areas of South Tripura indicates that there are no biochemical endemicity as the level was found more than 10 µg/dl. But the urinary iodine excretion pattern indicates that in an average 16.52% studied population had mild iodine deficiency, 4.35% had moderate iodine deficiency and 6.96% had severe iodine deficiency.

Lack of knowledge concerning some of the other causative factors of endemic goiter has prevented development of appropriate measure for its complete eradication in those areas where goiter persists inspite of iodine supplementation (16). The thiocyanate or thiocyanate like compounds present in several foods interfere in the thyroid gland with organification of iodine and formation of active thyroid hormones and their action can not be antagonised by iodine (17). The cruciferae plants, beans, turnip, sweet potato, bamboo shoots cabbage, cauliflower, radish, mustard etc. contain naturally occurring goitrogenic compounds often/ occasionally consumed by the people of the region as evidenced by the presence of thiocyanate in good concentration in urine samples collected from Jolaibari and Bhuratali. The assay of urinary thiocyanate concentration in other areas have been undertaken and will be reported.

The recommended level of iodine in the

edible salt is 15 ppm at the consumption level in our country (18). The present study shows that two thirds salt samples (66.94%) had iodine level below the recommended 15 ppm.

This work therefore suggests that low iodine intake along with the consumption of cyanogenic foods (thiocyanate precursors) may be responsible for the persistence of IDD in the studied region.

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